PATENT SPECIFICATION

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Complete Specification Left: May 26, 1939.

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PROVISIONAL SPECIFICATION

Improvements in and relating to Rock and like Drills

We, HOLMAN BROTHERS LIMITED, a British Company, of Camborne, in the county of Cornwall, and JAMES RULE, a British Subject, of 54, Hughville Street, Camborne, in the county of Cornwall, do hereby declare the nature of this invention to be as follows:—

This invention relates to rock and like drills of the rotary abrasive type and particularly to what are known as core drills using abrasive diamond bits.

We have found that great advantages accrue, both as regards eliminating the difficulties arising from core breakage and the wear of the drill bits, if the motion of the drill spindle is rapidly reversed from time to time so as to produce a rotary reciprocation, and we have also found that improved drilling speed is attained, if in addition to rotating a drill of this type a rapid axial reciprocation is imparted to it.

Our invention therefore consists broadly of a rock or like drill so driven as to have imparted to it, rapid and continuous circular reciprocations and our invention further comprises applying to the drill spindle, rapid axial reciprocation.

It is an important feature of the invention that these reciprocatory motions are attained by an element of the drill which is rotated continuously in one direction by the air or other motor of the drill, and does not necessitate any periodically operating reversing gear such as is necessary in those types of rotary drill where the drill is reversed after a number of rotations.

According to one embodiment of the invention, we provide a drill for operation from a pressure fluid supply source, preferably compressed air. The drill comprises a casing, the upper part of which houses the motor while in the lower part are arranged the means for producing the periodic axial movement of the drill shaft. The motor is of the crescent type, although, of course, other types of motor may be employed; the upper part of the housing has a cylindrical boring therein within which a rotor is eccentrically mounted on ball or roller bearings. The rotor has a plurality of vanes mounted within radial grooves in said rotor. Compressed air is admitted from an air supply inlet on the upper part of the casing to the crescent shaped chamber of the rotor, which is thereby driven in known manner. In order to control the speed of the rotor, the rotor shaft extends through the rear bearing and there carries a simple centrifugal device which operates to move a member thereof axially with increasing speed. This axial movement is then used to control, through a pivoted arm, a spring loaded valve in the air supply passage.

At its forward end the rotor shaft extends through the bearing and has keyed thereto a balanced crank. A pinion arranged within the casing is driven from the crank pin by means of a floating rack engaging the crank pin at one end and being held in engagement with the pinion at the other end by a guide, in which the rack is free to slide, embracing the pinion shaft.

This pinion shaft has a driving pinion keyed thereto which engages gear teeth formed on a drill spindle driver sleeve carried on suitable bearings in the lower part of the casing. The forward end of this sleeve is adapted to receive the shank of the drill shaft; where this is hollow, as is the case with diamond core drills, to which the invention is particularly applicable, and water is to be fed through the bore in the drill a water chamber is arranged surrounding the forward part of the sleeve, whereby water may be supplied from a water inlet on the casing to the water chamber and thence through apertures in the sleeve and the drill shank to the drill bore. Suitable packing washers are provided between the sleeve and the casing.

In this way rotation of the motor causes the rack to be oscillated by the crank, and there is thereby imparted to the pinion and hence drill shaft, a semi-rotary motion, or, in other words, a circular reciprocation. The angular extent of the motion in each direction will be determined by the crank throw and by the gear ratios but in general it will be of the order of one rotation or less; in one example, which gave satisfactory results, the drill was rotated through 187° in

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either direction before being reversed.

In addition to its being rotated or reciprocated in this manner, the drill sleeve is reciprocated axially. To this end the sleeve is arranged to be axially movable and at its rearward end, it is provided with a cam ring or surface, arranged to bear against a cam roller. The roller is carried in a cage which is axially adjustable by means of a screw thread and nut. As the sleeve rotates, therefore, the cam rides over the roller, causing the sleeve to reciprocate.

The axial reciprocations imparted by the cam ring are not for any purpose of applying an impulsive blow to the drill bit, but in order that the direct pressure sustained upon the drill by the operator is periodically relieved by causing the machine to be intermittently lifted in the direction opposite to that of the thrust of the operator. It will be apparent that the resultant force produced by the reciprocations, though small, will in fact be transferred to the drill bit.

The axial movement causes vibration of the drill, and to absorb the vibration, the handles of the drill are pivoted on vertical pivots, with extensions at the inward ends of the handles and at right angles thereto held together under spring tension. The handles are therefore capable of pivoting under the tension of the springs so as to afford a resilient mounting of the handles with respect to the body of the drill.

Dated this 9th day of November, 1938.

A. A. THORNTON,
Chartered Patent Agent,
7, Essex Street, Strand, London, W.C.2.
For the Applicants.

COMPLETE SPECIFICATION

Improvements in and relating to Rock and like Drills

We, HOLMAN BROTHERS LIMITED, a British Company, of Camborne, in the county of Cornwall, and JAMES RULE, a British Subject, of 54, Hughville Street, Camborne, in the county of Cornwall, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to rock and like drills of the rotary abrasive type and particularly to what are known as core drills using abrasive diamond bits.

We have found that great advantages accrue, both as regards eliminating the difficulties arising from core breakage and the wear of the drill bits, if the motion of the drill spindle is rapidly reversed from time to time so as to produce a rotary reciprocation, and we have also found that improved drilling speed is attained, if in addition to rotating a drill of this type a rapid axial reciprocation is imparted to it.

Our invention therefore consists broadly of a rock drill in which the drill is rotated in opposite directions alternately, the rotary movement in each direction being not substantially greater than one revolution.

In practice we have found that movement of less than one revolution produces satisfactory results.

The invention further comprises means for effecting rapid axial reciprocation of the drill simultaneously with the rotary movements.

It is also an important feature of the invention that these reciprocatory motions are attained by an element of the drill which is rotated continuously in one direction by the air or other motor of the drill, and does not necessitate any periodically operating reversing gear such as is necessary in those known types of rotary drill where the drill is periodically reversed after a number of rotations in each direction.

In the accompanying drawings are shown by way of example one embodiment of the invention; in these drawings, Figure 1 is an end view of a hand drill and Figures 2, 3 and 4 are respectively a longitudinal section, a transverse section on line III—III of Figure 2 and a plan view of the same drill.

In this embodiment of the invention, there is provided a drill for operation from a pressure fluid supply source, preferably compressed air. The drill comprises a casing 10, the upper part 10*a* of which houses the motor 11 while in the lower part 10*b* are arranged the means for producing the periodic axial movement of the drill shaft. The motor is of the crescent type, although, of course, other types of motor may be employed; the upper part 10*a* of the housing has a cylindrical boring therein within which a rotor 11*a* is eccentrically mounted on ball or roller bearings 11*b*, 11*b*. The rotor has a plurality of vanes 11*c* mounted within radial grooves in said rotor 11*a*. Compressed air is admitted from an air supply inlet 12 on the uppar part 10*a* of the casing to the crescent shaped chamber of the rotor, which is thereby driven in known manner. In order to control the speed of the rotor, the rotor shaft 11*d* extends

through the rear bearing 11*b* and there carries a simple centrifugal device 13 which operates to move a member 13*a* thereof axially with increasing speed. This axial movement is then used to control, through a pivoted arm 13*b*, a spring loaded valve 14 in the air supply passage from inlet 12.

At its forward end the rotor shaft 11*d* extends through the bearing 11*b* and has keyed thereto a balanced crank 15. A pinion 16 arranged within the casing is driven from the crank pin 15*a* by means of a floating rack 17 engaging the crank pin at one end and being held in engagement with the pinion 16 at the other end by a guide 17*a*, in which the rack is free to slide, embracing the pinion shaft 16*a*.

This pinion shaft 16*a* has a driving pinion 18 keyed thereto which engages gear teeth formed on a drill spindle driver sleeve 20 carried on suitable bearings 20*a* in the lower part of the casing. The forward end 19*b* of a member 19 arranged within the sleeve and keyed thereto at 19*c* is adapted to receive the shank of the drill shaft 21; where this is hollow, as is the case with diamond core drills (to which the invention is particularly applicable) and water is to be fed through the bore in the drill a water chamber 22 is arranged surrounding the forward part of the sleeve. Water may then be supplied from a water inlet 22*a* on the casing to the water chamber and thence through apertures in the forward portion 19*b* of the sleeve 19 and the drill shank 21 to the drill bore. Suitable packing washers 23 are provided between the sleeve and the casing.

In this way rotation of the motor causes the rack to be oscillated by the crank, and there is thereby imparted to the pinion and hence drill shaft, a semi-rotary motion, or, in other words, a circular reciprocation. The angular extent of the motion in each direction will be determined by the crank throw and by the gear ratios but in general it will be of the order of one rotation or less; in the example described, which has given satisfactory results, the drill rotates through 187° in either direction before being reversed.

In addition to its being rotated or reciprocated in this manner, the drill sleeve is reciprocated axially. To this end the member 19*a* coupled to the sleeve is arranged to be axially movable but rotatably fixed with respect to the sleeve by the feather 19*c* and at its rearward end the member 19 is provided with a cam ring or surface 19*d* arranged to bear against a cam roller 24. The roller is carried in a cage 24*a* which is axially adjustable by means of a screw thread 24*b* on the cage and a nut 24*c* thereon. As th sleeve rotates, theref re, the cam 19*d* rides over the roller 24, causing the member 19 and hence the drill to reciprocate.

The axial reciprocations imparted by the cam ring are not for any purpose of applying an impulsive blow to the drill bit, but in order that the direct pressure sustained upon the drill by the operator is periodically relieved by causing the machine to be intermittently lifted in the direction opposite to that of the thrust of the operator. It will be apparent that the resultant force produced by the reciprocations, though small, will in fact be transferred to the drill bit.

The axial movement causes vibration of the drill, and to absorb the vibration, the handles 25 of the drill are pivoted on vertical pivots 25*a*, with extensions 25*b* at the inward ends of the handles and at right angles thereto held together under the tension of springs 25*c*. A packing washer 25*d* may be arranged between the extensions 25*b*. The handles 25 are thus capable of pivoting under the tension of the springs so as to afford a resilient mounting of the handles with respect to the body of the drill.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A rock or like drill in which the drill is rotated in opposite directions alternately, the rotary movement in each direction being not substantially greater than one revolution.

2. A rock or like drill in which the drill is rotated in opposite directions alternately, wherein said alternation is produced by means of a continuously rotating member.

3. A rock or like drill in which the drill is rotated in opposite directions alternately and is simultaneously reciprocated axially whereby the direct pressure upon the drill imparted during operation is periodically relieved.

4. A rock or like drill according to claim 1, wherein the rotary movement in each direction is less than one revolution.

5. A rock or like drill according to claim 2, wherein the drive from said continuously rotating member to the drill is effected by means including a crank driven from said member.

6. A rock or like drill according to claim 5, wherein said crank is arranged to impart the alternating motion to the drill by means of a rack and pinion.

7. A core drill comprising a drill to which are imparted simultaneously rapid rotary movements in opposite directions

alternat ly and rapid short reciprocations axially.

8. A core drill substantially as described with referenc to th accompanying drawings.

Dated this 26th day of May, 1939.

A. A. THORNTON,
Chartered Patent Agent,
7, Essex Street, Strand, London, W.C.2.
For th Applicants.

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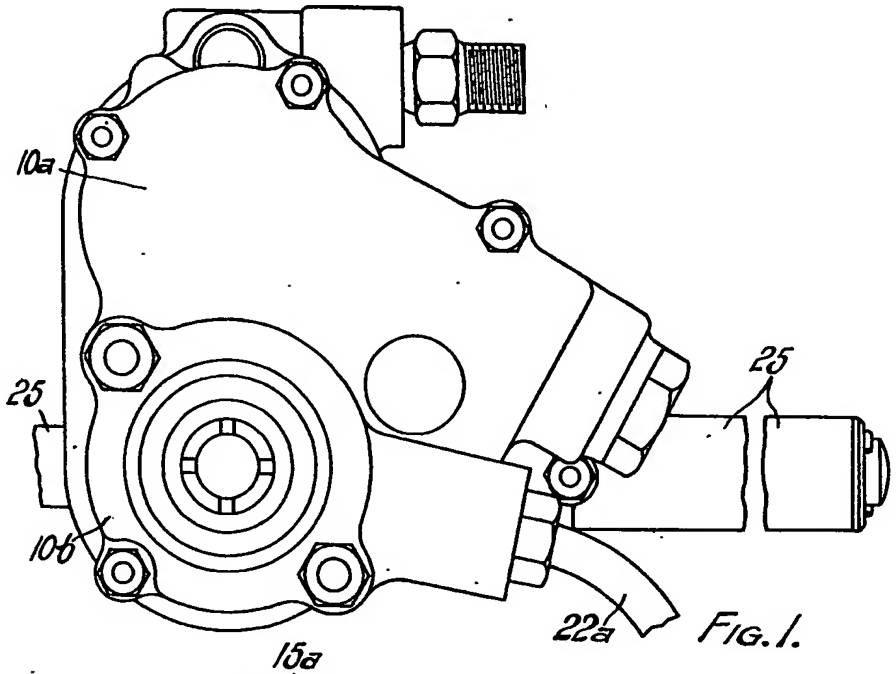

FIG. 1.

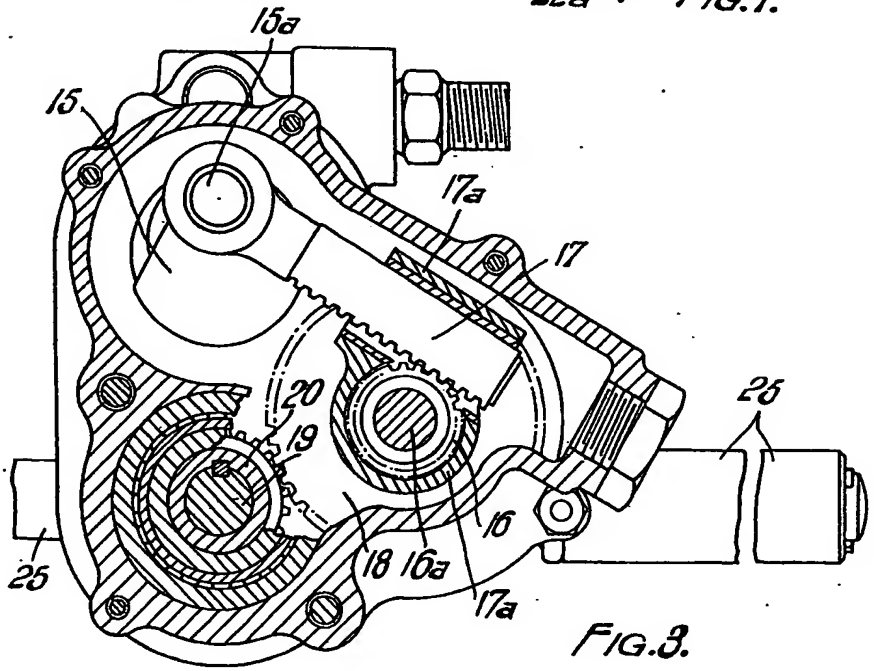

FIG. 3.

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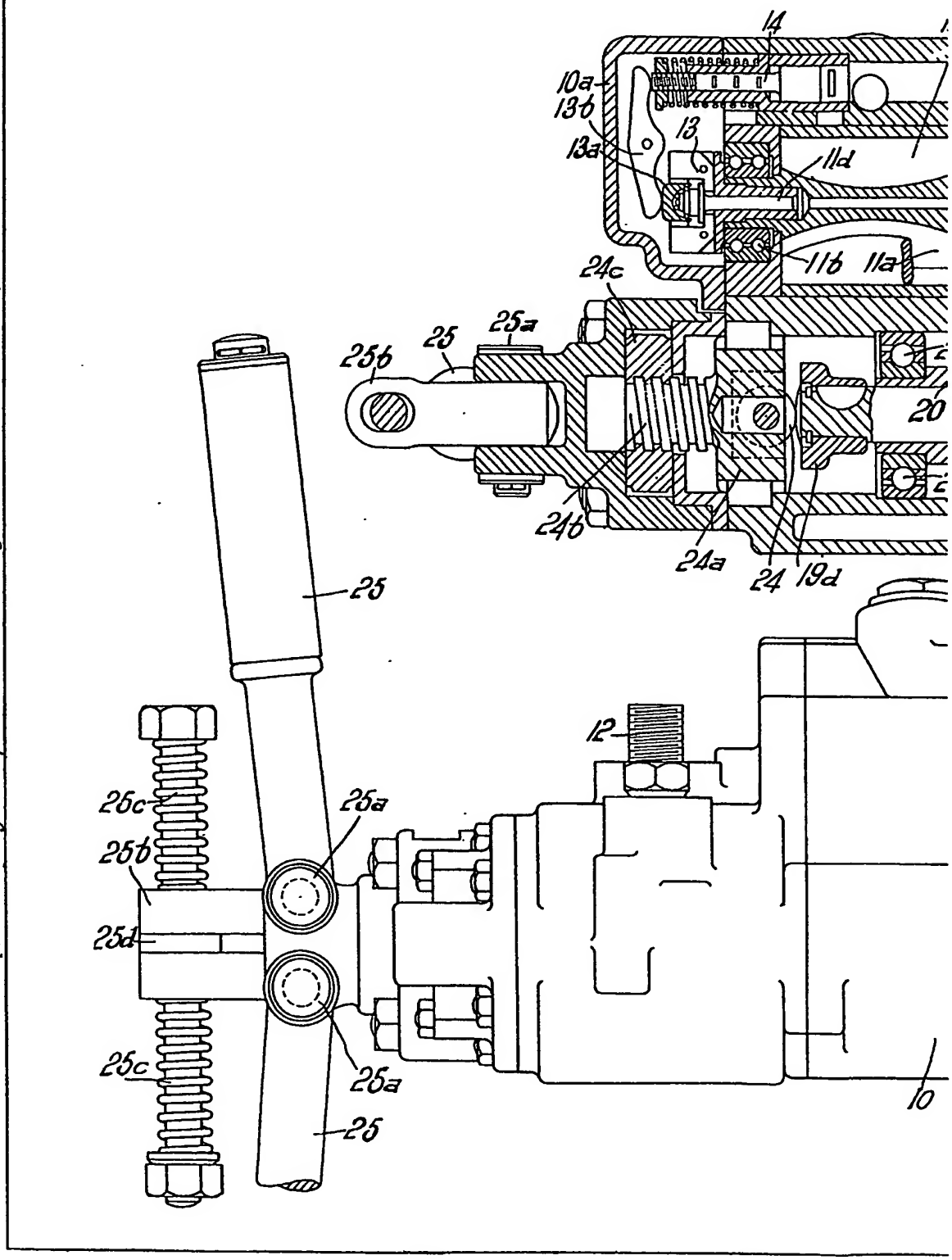

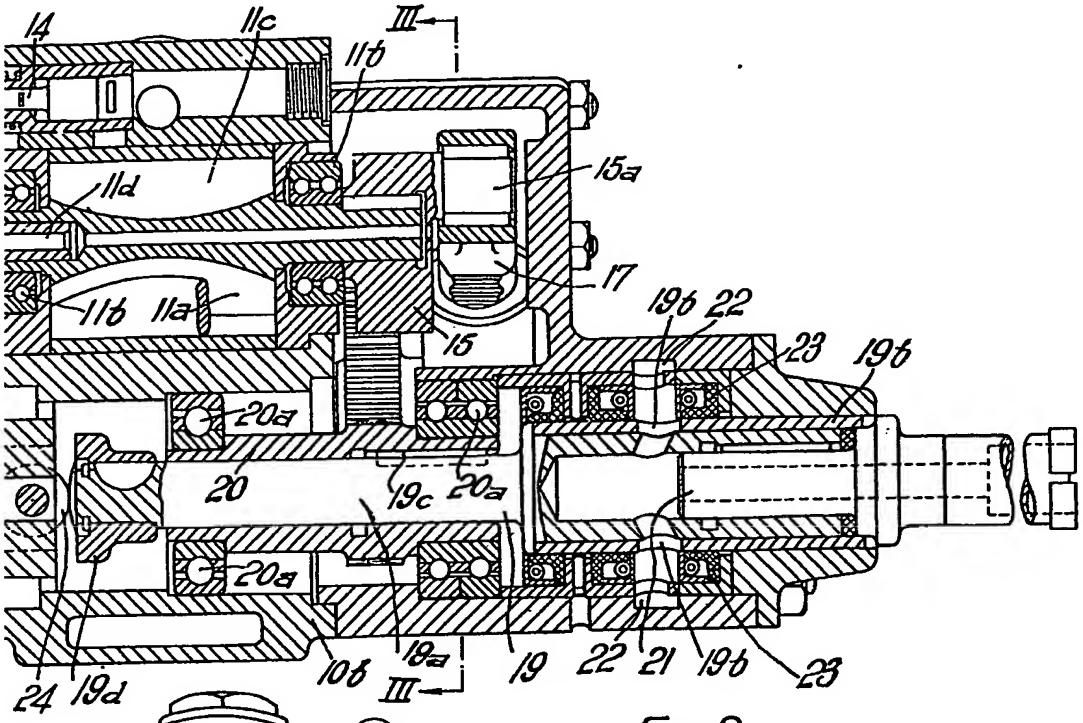

FIG. 2.

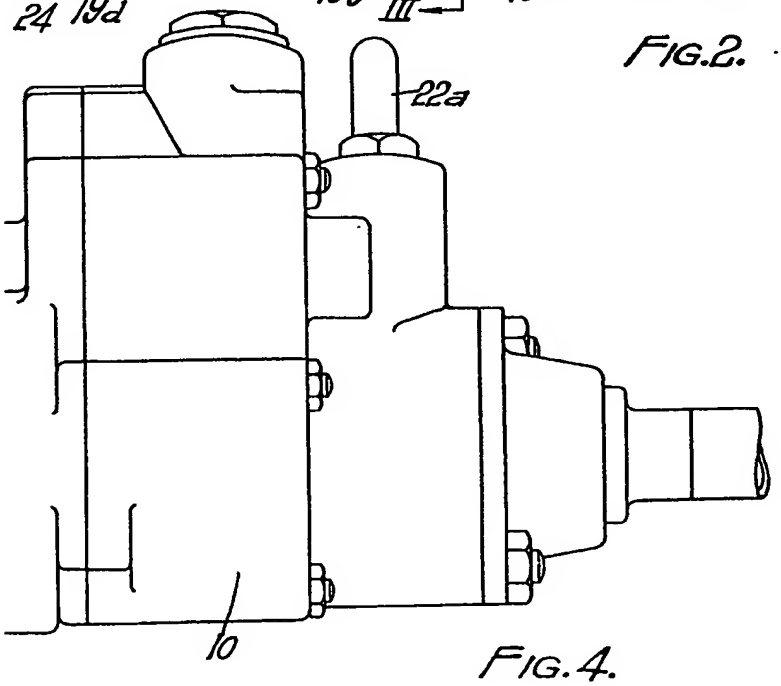

FIG. 4.

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521,018 COMPLETE SPECIFICATION

2 SHEETS
SHEET 2

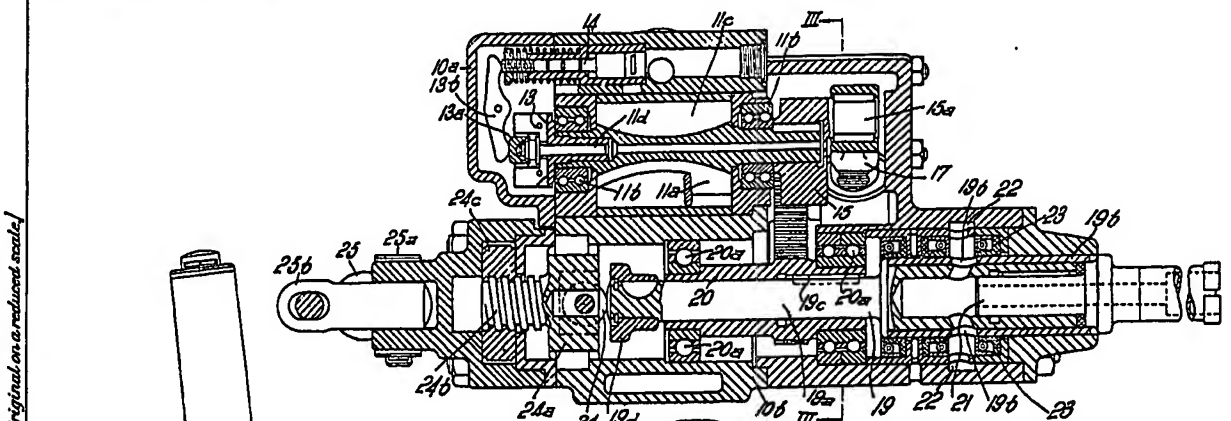

FIG. 2.

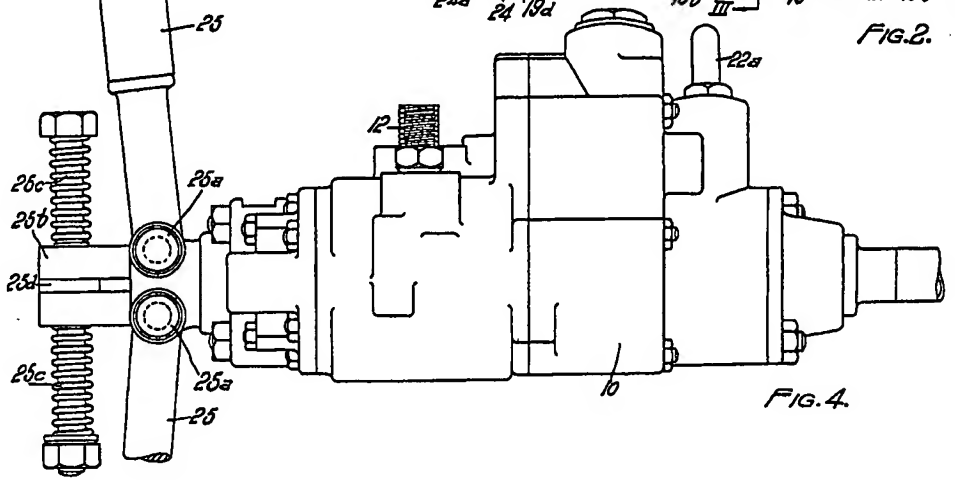

FIG. 4.

[This Drawing is a reproduction of the Original on a reduced scale.]

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